THURSDAY, SEPTEMBER 5, 1907.

MARIGNAC'S COLLECTED PAPERS.

Œuvres complètes de Jean-Charles Galissard de Marignac. Edited by E. Ador. In two vols. Vol. i. (1840–1860), pp. lv + 701, with a portrait; vol. ii. (1860–1887), pp. 839. (Geneva: Ch. Eggimann et Cie.; Paris: Masson et Cie.; Berlin: Friedländer und Sohn.)

AMONG the great chemists of the nineteenth century, and especially those engaged with inorganic chemistry, Jean-Charles Galissard de Marignac takes high rank, and in the notable advances which were made in chemical science during his lifetime he played a conspicuous part. The pride which his native city felt in his long and fruitful career has found expression in this sumptuous edition of his published papers, a worthy monument to the untiring energy that characterised him all his life so long as strength remained. It has been issued under the auspices of the Société de Physique et d'Histoire naturelle. The editing has been entrusted to the capable hands of his son-in-law and, for a time, colleague, Prof. E. Ador, who has executed what was evidently a labour of love with reverent care, and has contributed the interesting sketch of the life and works of Marignac which prefaces the first volume.

Marignac's personal life seems to have been singularly uneventful. Sprung from a French family which had settled in Geneva early in the eighteenth century, he was born in that city in 1817. With the view of entering the French service as a mining engineer, he underwent the course at the École polytechnique at Paris, and in accordance with the enlightened custom that prevailed in that country was dispatched at the end of his training on a scientific mission to foreign countries in order to study their methods. While at Stockholm he made the acquaintance of Berzelius, and there can be little doubt this meeting had a profound influence on the course of his life and turned his bent more definitely towards chemistry. At any rate, when, soon after his return to France, he was offered the chair of chemistry at the Academy of Geneva, he, despite the, from a worldly point of view, far better prospects that awaited him in France, accepted the offer without hesitation; and, as it turned out, he filled the post for thirty-eight years, until in 1878 failing health compelled him to tender his resignation.

It is pleasant to note the sympathetic consideration which Marignac experienced from the French Government. He was permitted to vacate his post and yet to retain the title of Ingénieur des Mines, and in the course of his letter the Minister of Public Works remarked:—

"Le gouvernement français ne peut voir qu'avec faveur que le gouvernement de Genève vienne chercher en France les hommes auxquels il confie le soin de répandre les lumières de la science, et, en remplissant avec distinction le poste qui vous est confié, ce sera encore un service indirect que vous rendrez à la France."

Shy and retiring by nature, he seemed to find happiness only in his laboratory; indeed, it was with considerable reluctance that he tore himself away for a few days at the time of his marriage. To quote Prof. Ador:—

"Marié en 1845, c'est à peine s'il consent à s'éloigner pendant quelques jours de son laboratoire; il emporte chaque matin un petit pain qu'il dévore à la hâte, ne pouvant se décider à interrompre ses travaux au milieu du jour";

a picture of a thinker, absorbed in his work and almost oblivious of every-day life. He shunned any position which brought him before the public gaze, and to the end found it irksome to lecture before a fresh generation of students.

The conditions under which most of Marignac's work was performed would be rather a shock to those accustomed to the greater luxury of these latter days. His laboratory is described by Prof. Ador thus:—

"Cette méchante cuisine enfouie dans le sous-sol, sombre en plein midi, avec ses cornues de grès ou de verre qui lui donnaient l'air d'une officine d'alchemiste."

Yet amid such forbidding surroundings were carried out elaborate researches with a care and completeness such as would be with difficulty surpassed at the present day even with the advantage of the improved apparatus now available. More commodious premises were eventually provided in 1873 when the academy was transformed into the university; but not long afterwards he was compelled to retire, and, although for a few years he continued work in his private laboratory, his strength at length failed so completely that he was practically confined to his couch. He died in 1894. The excellence of his work was recognised by the numerous honours conferred upon him; among them we may note that he was elected in 1881 a corresponding member of the Royal Society, and received in 1886 the Davy medal.

At the time when Marignac went to Geneva, the atomic weight of few of the elements had been at all accurately determined, and although some confidence might be felt in the numbers obtained by such a master as Berzelius, it was imperative that they should be confirmed by independent investigators and by other methods. There was at the time considerable speculation as to the question of the rigid application of Prout's law. Perceiving the pressing need for further trustworthy determinations of these fundamental data, on which the whole fabric of chemical science is based, Marignac resolved to devote his scientific energy to this important investigation. As was pointed out by Stokes, the president of the Royal Society, when bestowing on him the Davy medal, his work was the more important since he gave so much of his attention to the atomic weights of the more common elements on which the determination of new atomic weights is generally made to depend. In the whole of his researches he exercised the greatest care in considering the possibilities of error which might have occurred in the operations of

previous workers, and displayed more than ordinary ingenuity in devising new methods to avoid such errors, and at the same time he paid particular attention to the necessity of employing the purest material in such work. He was never satisfied with even repeated experiments on different amounts by the same method, and always, whenever practicable, adopted two or more independent methods. If we include those elements which he did not completely study, he determined the atomic weights of no fewer than twenty-nine of the elements, and in nearly every case his numbers differ little from those now adopted —a remarkable feat for one man working without any assistance. In the course of his investigations he analysed certain of the minerals containing the rare earths, and succeeded in separating two new elements, ytterbium from gadolinite and gadolinium from samarskite.

The process of time has brought it about that much of his work begins to have mainly historical interest, and probably at the present day most chemists will feel more vivid interest in researches which were to some extent incidental to the principal investigation. Prominent among these is his elaborate work relating to the intricate and puzzling problem in analysis presented by titanium, niobium, and tantalum. So difficult is the separation of these three elements, when occurring together in the same substance, that many eminent chemists have imagined the existence of other elements; for instance, Hermann strongly insisted on the presence of ilmenium in samarskite, but Marignac showed it to be really a mixture of niobium and tantalum. Although it cannot be said that he solved the problem with complete success, yet Marignac was the first to devise a method—the differing solubilities in hydrofluoric acid of the double fluorides of the three elements with potassium—which effected any real separation, and which to this day has not been superseded by any more satisfactory. The problem is one that still awaits solution, and is occupying the attention of many chemists. It is of interest to note that, in recognition of the method devised by him, the name marignacite was recently assigned by Mr. Weidman and Mr. Lenher to a variety of pyrochlore from Wausau, Wisconsin. Of little less vivid interest is his comprehensive investigation relating to the formula of zirconia and the atomic weight of the element. He made use of the law of isomorphism propounded by Mitscherlich, of which he was early a keen advocate, and undertook a complete chemical and crystallographical examination of a large number of fluozirconates. None of his experiments lent any confirmation to the idea put forward by Svanberg that zirconia contains three distinct metallic oxides. Nevertheless, the question is one deserving of further consideration. Prof. Church and other observers have noted a remarkable range in the density of zircons, 4·0 to 4·7, and an even more remarkable alteration in the density effected in certain stones of low density by the application of heat, and the conclusion has been drawn that there are three varieties of zircon. Further, the crystallised native zirconia, baddeleyite, presents almost as wide a range of density, which is even more difficult to understand in the case of an apparently simple oxide. It is possible that zirconium has never been completely isolated; it is well known that a satisfactory method for separating it from titanium has yet to be found.

Marignac found time to examine the chemical and crystallographical characters of a large number of minerals, and also of artificial salts prepared by him in the laboratory. The sentence with which he opens one of his elaborate papers is indicative of the thoroughness characterising his work, and embodies a maxim which even now is by no means universally appreciated by chemists:—

"L'intérêt que présente l'étude des formes cristallines des divers composés chimiques, m'a engagé à ne jamais négliger de déterminer exactement les formes de ceux qui s'offraient à moi, en cristaux déterminables, dans le cours de mes travaux de laboratoire."

Towards the end of his career his attention was attracted to the physical side of chemistry, and he carried out with his customary skill and care a lengthy series of thermochemical determinations; unfortunately, the complete collapse of his physical vigour brought his work to a premature close. To his other investigations—for instance, on ozone—space will not permit us to allude.

As regards the appearance of the volumes, the quality of the paper and the style of the printing are beyond criticism, and care has been taken to indicate the original pagination. Most of the papers were published in the *Bibliothèque Universelle de Genève* or the *Annales de Chimie et de Physique*; those dealing with mineralogical subjects appeared in the *Annales des Mines*.

THE BLOOD-SUCKING GNATS.

A Monograph of the Culicidae or Mosquitoes. Mainly Compiled from Collections received at the British Museum. Vol. iv. By F. V. Theobald. Pp. xix+639; 16 plates. (London: Printed by order of the Trustees, 1907. Sold by Longmans and Co., B. Quaritch, Dulau and Co., and at the British Museum [Natural History].) Price 1*l.* 12*s.* 6*d.*

THIS work forms the second supplementary volume to Mr. Theobald's original monograph of the Culicidæ of the world, in two volumes, published by the trustees of the British Museum in 1901. The present volume deals very largely with the new species which have been added to the national collections, and besides these it also embodies the descriptions of one hundred and sixty species which have been described by various authors since the issue of the first supplementary volume in 1903.

It would be difficult to overestimate the great scientific value of Mr. Theobald's most exhaustive faunistic work on these insects. It is a model of painstaking scientific accuracy, and we congratulate him on its issue.

With the exception of the adoption of a few characters in an admirable scheme of general